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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/786,813	03/09/2001	Mark E McNie	124-847	6714

7590

03/27/2003

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EXAMINER

MOORE, KARLA A

ART UNIT

PAPER NUMBER

1763

DATE MAILED: 03/27/2003

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/786,813

Applicant(s)

MCNIE, MARK E

Examiner

Karla Moore

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 January 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-23 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 06 January 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

Drawings

1. The corrected or substitute drawings were received on 01/06/03. These drawings are approved as they provide a clearer depiction of Applicant's invention.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-9, 13, 16-20 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,427,975 to Sparks et al. in view of U.S. Patent No. 5,364,497 to Chau et al.
4. Sparks et al. disclose a micro-machining method of bridging a channel (Figures 9 a-d, 22) with at least one bridging material (50), the channel being provided in a second material (10) substantially as claimed. The method comprising the steps of: partially filling said channel with an infill material (48) at an uppermost region of said channel (column 12, rows 25-29); patterning (column 12, rows 29-32) said infill material; and depositing at least one bridging material onto said infill material (column 12, rows 34-38).
5. Examiner notes that the channel is only "partially filled" with infill material, due to the fact that a suspended portion (micromachined element, 18) is also present in the channel. It is also noted that although the infill material is not present exclusively in the uppermost region of the channel, it does meet the limitation as claimed, which only requires that the infill material be present "at an uppermost region of the channel".
6. With respect to claim 2, the method further comprises: removing the infill material once the at least one bridging material has been provided leaving the at least one bridging material bridging said

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channel. As detailed above, the bridging layer (50) is deposited before the infill layer (48) is removed using an etching technique.

7. With respect to claim 3, the method further comprises: providing at least a portion of the at least one bridging material which is freely suspended above the second material (see Figures 9c and 9d).

8. With respect to claim 4, the method further comprises: micro-machining structures form a second material and creating at least one device suspended portion (18; column 4, rows 57-65), which is substantially free from the bulk of the second material and providing at least one channel separating the device suspended portion from the bulk of the second material and providing the freely suspended portion of the at least one bridging material extending over the channel.

9. With respect to claim 5, the method further comprises: performing a sacrificial etch to release the device suspended portion from the bulk of the second material before the infill material is provided (column 6, rows 35-47).

10. With respect to claims 6/4 and 6/5, the method further comprises: creating the freely suspended portion of the at least one bridging material extending over the device suspended portion. Creation of the bridge is detailed above.

11. With respect to claim 7, the method further comprises: performing the sacrificial etch to release the device suspended portion from the bulk of the substrate after the infill material is provided. Examiner notes that in its broadest interpretation, the phrase "release the device suspended portion from the bulk of the substrate/second material" could be characterized by the etching step, which frees up the space occupied by the infill material between the substrate/second material and the device suspended portion.

12. With respect to claim 8, the at least one bridging material is not substantially etched by the sacrificial etch (see Figure 9d).

13. With respect to claim 9, the bridging material is taught to be silicon nitride (column 12, row 36), which is thermally conductive.

14. With respect to claim 13, Sparks et al. teach that polysilicon may be used as the infill/sacrificial material (column 3, rows 62-65).

15. With respect to claim 15, the infill material is deposited using a spinning process, which necessarily means that the method of application causes the infill material to expand laterally across the channel.

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16. With respect to claim 16, the method further comprises causing the deposited material (50) to cap the channel sealing the channel at the top region (see Figure 9b)

17. With respect to claim 17, the method also further comprises using an etching process to remove the infill (48) material (column 12, rows 49-51).

18. With respect to claims 18 and 19, the infill material is disclosed as being a polyamide (column 12, rows 14-16). Additionally, the infill material may be applied using a flowing technique (spinning process) so that it flows into the channel (column 12, rows 25-27).

19. With respect to claim 20, a dry etching technique, for example plasma oxygen etch, may be used to remove the infill material (column 12, rows 49-51).

20. As detailed above Sparks et al. disclose the method substantially as claimed.

21. However, Sparks fails to teach patterning and etching said infill material to form a hole through the infill material to the second material and depositing at least one bridging material so that at least one portion of the at least one bridging material contacts the second material through the hole.

22. Chau et al. teach selectively etching (i.e. patterning and etching) a sacrificial layer to open up a number of holes in the sacrificial layer down to a substrate (second material) and subsequently depositing microstructure (bridging) material for the purpose of providing holes in which anchors for supporting a microstructure (bridge) will be formed (column 1, rows 24-46).

23. It would have been obvious to one of ordinary skill in the art at the time the Applicant's invention was made to have provided a method step for patterning and etching a sacrificial layer and subsequently depositing microstructure material in Sparks et al. in order to form holes in which anchors for supporting a microstructure can be formed as taught by Chau et al.

24. Claims 9-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sparks et al. and Chau et al. as applied to claims 1-9, 13, 16-20 and 23 above, and further in view of U.S. Patent No. 5,620,933 to James et al.

25. The prior art relied upon above discloses the invention substantially as claimed and as described above.

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26. However, the prior art fails to teach the use of an electrically conductive bridging material, a plurality of bridging materials to bridge a channel or providing a supporting layer along with one or more conductive layers within the bridge over the channel.

27. With respect to claim 9, James et al. disclose a method comprising depositing an electrically conductive material as the at least one bridging material for the purpose of using the structure as an electrical relay used to close electrical circuits or establish selective paths for the flow of electrical current (column 1, rows 9-12; column 4, rows 20-37).

28. It would have been obvious to one of ordinary skill in the art at the time the Applicant's invention was made to have provided a method comprising depositing an electrically conductive material as the at least one bridging material in order to use the structure as an electrical relay as taught by James et al.

29. With respect to claims 10 and 11, James et al. teach the use of a plurality of bridging materials to form complimentary layers: a masking layer, an electrically conductive layer and an insulating layer. The masking layer is provided for the purpose of preventing the electrically conductive layer from being undercut when a cavity is etched (column 4, rows 30-32); the electrically conductive layer for dissipation of any charge that may accumulate on the insulating layer (column 7, rows 2-4); and the insulating layer for insulation (column 4, rows 20-24).

30. It would have been obvious to one of ordinary skill in the art at the time the Applicant's invention was made to have provided a plurality bridging materials in the prior art in order to have the plurality of materials form complimentary layers serving different purposes (as described above) in the formation of a relay device as taught by James et al.

31. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sparks et al. and Chau et al. as applied to claims 1-9, 13, 16-20 and 23 above, and further in view of U.S. Patent No. 5,798,283 to Montague et al.

32. The prior art discloses the invention substantially as claimed and as described above.

33. However, the prior art fails to teach deposition of the infill material using Plasma Enhanced Chemical Vapor Deposition (PECVD).

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34. Montague et al. teach the use of PECVD for deposition of an infill/sacrificial material based on the conventionality of the method (column 6, rows 56-65).

35. It would have been obvious to one of ordinary skill in the art at the time the Applicant's invention was made to have used PECVD for depositing the infill/sacrificial material in the prior art in order to take advantage of the conventionality of the method as taught by Montague et al.

36. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sparks et al. and Chau et al. as applied to claims 1-9, 13, 16-20 and 23 above, and further in view of U.S. Patent No. 5,656,123 to Salimian et al.

37. The prior art discloses the invention substantially as claimed and as described above.

38. However, the prior art fails to teach using a dual frequency PECVD system to deposit the infill material wherein the plasma is generated at a first frequency and the "plasma species" is accelerated toward the second material at a second frequency.

39. Salimian et al. teach the use of a dual frequency PECVD system for the purpose of individually controlling different physical phenomena, which may or may not be desirable within a process. Salimian teach permitting a first frequency at a first electrode to predominantly control and power the plasma (generation) while a second frequency provides wafer bias to control the sheath potential (determines acceleration) between a second electrode at the wafer and the plasma (column 2, row 54 through column 3, row 8).

40. It would have been obvious to one of ordinary skill in the art at the time the Applicant's invention was made to have provided a dual frequency PECVD system in the prior art in order to independently control different physical phenomena of the plasma, such as generation and acceleration, which may or may not be desirable within a process as taught by Salimian.

41. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sparks et al. and Chau et al. as applied to claims 1-9, 13, 16-20 and 23 above, and further in view of U.S. Patent No. 5,275,973 to Gelatos.

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42. The prior art disclose the invention substantially as claimed and as described above, including using a mask to develop the infill material (Sparks, column 12, rows 29-32) and then etching to remove portions of the infill material (Chau et al. rows column 1, rows 24-46).

43. However, the prior art fails to teach using photoresist as an infill material.

44. Gelatos teach that photoresist, like polyamide, may be use as an infill/sacrificial material because it is imagable (column 3, rows 1-7).

45. It would been obvious to one of ordinary skill in the art at the time the Applicant's invention was made to have provided photoresist as an infill/sacrificial material in the prior art in order to take advantage of the materials imagability as taught by Gelatos.

46. Claim 22 rejected under 35 U.S.C. 103(a) as being unpatentable over Sparks et al. and Chau et al. as applied to claims 1-9, 13, 16-20 and 23 above, and further in view of U.S. Patent No. 5,747,353 to Bashir et al.

47. The prior art discloses the invention substantially as claimed and as described above, including: using a polyamide as the infill material (Sparks et al. column 12, rows 13-15) and subsequently applying a mask on top of the infill material to allow the material to be patterned (Sparks, column 12, rows 29-32) and etched (Chau et al. column 1, rows 24-46).

48. However, the prior art fails to teach the use of a photoresist as the mask.

49. Bashir et al. teach the use of a photoresist as a mask for the purpose of defining regions which will be subjected to an etch process (column 4, row 67 through column 5, row 2).

50. It would have been obvious to one of ordinary skill in the art at the time the Applicant's invention was made to have provided a photoresist as a mask in the prior art in order to define regions which will be subjected to an etch process as taught by Bashir et al.

Response to Arguments

51. Applicant's arguments directed to the rejection of claims 1-8 and "patterning and etching said infill material to form a hole through the infill material to the second material", see Paper No. 5, filed 01/06/03, have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Chau et al.

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52. Additionally, Applicant's argument with respect to "partially filling said channel with infill material" versus "completely filling said channel with infill material" has been considered. However, as noted above, the claim language does not distinguish over the cited prior art. Examiner believes that because of the volume that the suspended portion represents in the prior art (and in the claimed invention), characterizing the infill material as "partially" filling the channel is a correct interpretation. Examiner recognizes that there are differences between the extent to which the channel is filled in the prior art and the claimed invention and suggests that Applicant amend to better clarify this difference in order to overcome the Sparks et al. reference.

Conclusion


53. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Karla Moore whose telephone number is 703.305.3142. The examiner can normally be reached on Monday-Friday, 8:30am-5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory Mills can be reached on 703.308.1633. The fax phone numbers for the organization where this application or proceeding is assigned are 703.872.9310 for regular communications and 703.872.9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703.308.0661.

km
March 24, 2003


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